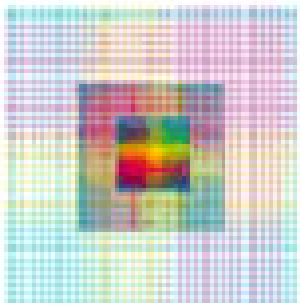

AUDIT II

Topic Report

Training, Authorisation and Quality Control

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1 Summary

Energy auditing was in many countries earlier seen as a multiple action activity not only reducing energy consumption but benefiting employment and competitiveness of companies and partly maybe also the political need to promote energy efficiency in general. Several well functioning energy audit programmes were terminated due to sudden changes in government policies, changes related to the economical situation in the country. Today the situation is different. Governments don't have easy solutions concerning their commitment to reduce GHG emissions. Energy audits in this light are now seen as an important tool but the new situation has also created a demand for concrete and measurable results – energy auditing is coming to be a serious business.

Energy auditor training, authorisation of energy auditors and quality control are three topics that have many connections and should be planned as stand-alone elements. The final aim of an energy audit activity is to get good energy audit reports, which provide the client adequate information for implementation of the measures. The Administrator and OA should therefore put a real effort in ensuring the best possible quality.

In principle, a good energy audit could be ensured by each of the following actions:

- Absolutely comprehensive and perfect training of energy auditors
- Authorising only those energy auditors who can come out with perfect reports
- Putting in place a quality control system which will cover 100 % of the reports and accept only perfect reports

Unfortunately in practice non of these actions can be put in place as such. The training option would be extremely expensive and time consuming. The authorisation option would mean that there are very few hand-picked auditors working. The quality control option would also be very expensive and it is unlikely that auditors and clients would accept the numerous comments-corrections rounds this option would no doubt lead to. However the OA can find a cost-effective and functioning solution from a combination of all these three action elements.

The basic idea is that these actions will be supporting and compensating each other. Light training and authorisation can be compensated by a strict quality control. On the other hand, if training and authorisation are demanding enough, the quality control can be lighter. The OA needs to analyse which combination works best in the country in concern but also in the energy audit activity in concern. The optimal combination is always country and programme specific and in this sense there is not a state-of-the-art combination, which could be recommended.

Although these three elements are probably the most connected elements in a programme level activity, there are unavoidable solid connections to other elements also to be taken into account. E.g. the energy audit models used in the activity naturally have an effect to the content and scope of the training and possibly also to the authorisation.

2 Introduction

This report is part of the AUDIT II project co-financed by the EU SAVE programme. The aim of the AUDIT II programme is to make a comprehensive overview of the Energy Audit programmes in the EU plus Norway as well as the applicant countries. Furthermore, the aim is to make an analysis of different topics related to energy audits and to establish a network between people working with energy audit programmes in each country.

This particular report deals with the topics of Energy Auditor Training, Authorisation of Energy Auditors and Quality Control. It is divided into three chapters:

- Chapter 3 deals with the different options in the training of energy auditors,
- Chapter 4 covers the authorisation of energy auditors and
- Chapter 5 the principles for the quality control of energy audits.
- In chapter 6 these various options are reflected to practical examples of existing energy audit activities.

Figure 1 illustrates briefly the trinity of training, authorisation and quality control, with the one small detail, pre-qualification, connected to training and authorisation. Training and authorisation are more a pair because after authorisation is often a normal continuity to training. In some cases it is difficult to say whether the issue is still on the training side or already a part of authorisation.

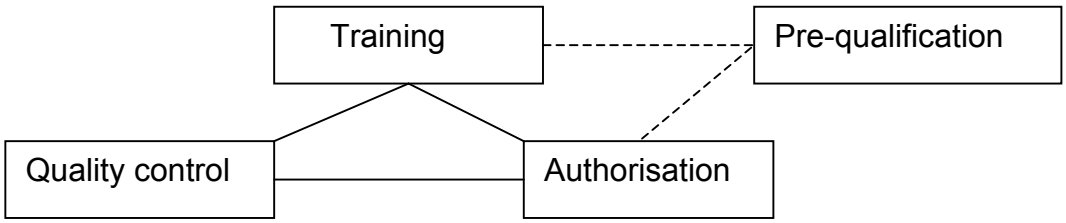


Figure 1 Connections of training, authorisation and quality control

Developing these three elements can be a circular process. Some of the choices between the different options can be done independently but some have an instant effect to the other elements or exclude some of the next options. Parallel to this planning process, the OA should estimate the needed human and financial resources. It is possible that at some point the need and availability of resources is no longer a match and something needs to be lightened and part of the planning process will be repeated.

3 Training

3.1 General

Training connected to an energy audit programme means that the persons who perform energy audits are trained - somehow by someone. In order to arrange training, which really fulfils the set goals when completed, there should be a clear understanding on the aim of the training – why do we need to train our energy auditors? This specified aim gives a better starting point for further planning. Although we in this report systematically refer to the Operating Agent (OA), the decisions on training can naturally be done either by the OA or the Administrator.

Some viewpoints or aims starting from the lowest level of requirements are e.g.

- To introduce the guidelines – just to explain how the game is played
- To introduce the audit methodology – how existing technical expertise should be applied in an energy audit
- To ensure the skills of the auditors – really improve the technical expertise of the auditors
- To create one part of a formal procedure for authorisation process – training is one door to be passed before entering the market place

Training of auditors requires a lot of resources, both human and financial, already at the planning stage. Energy auditing is also in fact really demanding as a working process. The training must be both planned and implemented by people who have comprehensive practical experience in the auditing business. Otherwise result of the training programme is likely to be unsatisfactory.

Depending on how the auditor training is arranged and integrated into a programme level energy auditing activity, a training programme can employ several people for a long period of time. The status of the training might lead into a situation where the training programme needs to be run as long as the EA programme itself. This is one issue to be take into consideration by the OA when a decision in done whether training will be arranged or not.

There are a few questions that should have been answers before the OA can continue with the planning process. From the viewpoint of the target sectors and set goals, there are at least the following questions:

- How many auditors are needed in the market place – based on the estimated or desired annual auditing volumes and the sectors the programme concerns
- How quickly they are needed – how fast is the market place expected to employ them
- What kind of skills are required from the auditors – in which sectors they will be working and which technical systems will be covered by the energy audit models used in the programme

Another set of questions concerns the auditors themselves

- What is a reasonable duration for training – in reference to the previous question but specifically in reference to the willingness of the auditors to participate in the training
- Who are the auditors – are the existing basic skills adequate or not
- Are different levels of training needed – one or several courses to be planned and arranged

These viewpoints are just to clarify the starting point. After these issues have been analysed and the aims clarified, the OA can start making decisions on different options step by step. The nature of the options is that one decision made will limit the number of next options or at least make some options clearly more unsuitable than others.

3.2 Basic choice

One question to be decided by the OA is the whether training will be arranged and in what way it will implemented. The four basic options, which all are in use in different countries and programmes are shown in figure 2.

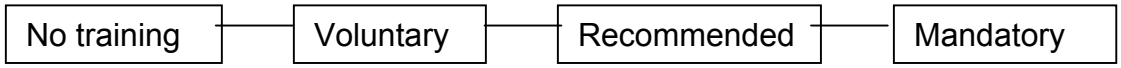


Figure 2. The basic options for the status of energy auditor training

No training

If ”no training” is chosen, there may still be some pre-qualifications for the auditors before they can enter the market. Authorisation may exist even if there is no training. In this way the training is by no means restricting the OA’s possibilities to develop a decent energy audit programme. Thus, the OA needs to understand where this choice leads to and what other decisions are needed in order to reach the set goals.

One good example of a situation where a training can clearly by seen unnecessary is when the target sector is very limited and the available auditors are very skilled but few in number. Here it is a good question whether the OA can really bring any added value to the audits by introducing a training programme. Especially if the audit models used are system specific (e.g. compressed air systems) and the auditors are system specialists, it is likely that the output of the audits is better without OA’s interference. But the larger the number of auditors is, even with skilled auditors, it is useful to harmonise the working procedures. The easiest way to do that is to arrange e.g. a workshop type of meeting where common approaches can be agreed on. According to the definitions agreed in this AUDIT II project this very light approach does not fulfil the criteria of actual auditor training.

Voluntary training

Voluntary training means that there are no incentives involved. There are numerous training courses, which do not provide the companies any other kind of edge in the market but employees with slightly better knowledge. Energy auditing can be one of these special areas where extensive training is given to those who are interested in it. If there is a market for this type of training, the professional training organisations will take care of it.

Recommended training

If the training is recommended by the OA, the idea should be that there are some incentives involved and this incentive should give the auditor's company some edge in the market compared to those who have had no training. The incentive could mean some marketing advantage, e.g. showing the trained auditors' names on OA's website where auditors' contact information is published. The minimum level might be a certificate (with an official status) given to all participants by the organiser of the training or by the OA. The certificate then can be used when marketing the energy audits. Still, recommended training is a voluntary approach.

Mandatory training

Mandatory training is really a condition to everyone interested in entering the market. Mandatory training is sometimes used in energy audit programmes, either as a part of an authorisation process or just as a separate training.

3.3 Pre-qualification for training

The idea of pre-qualification is that the OA defines some requirements for the persons who apply for energy auditor training. This is one way to "select" the suitable auditors. The options lead to different amount of work and resources required from the OA. One principle is that if any requirements are set, the OA should also be prepared to control that the requirements are followed. The first two options are very light approaches and do not really require any specific actions. If the option "required pre-qualification" is chosen, the OA must have the control process for this well planned in advance.

Different levels of pre-qualification may lead to different levels of training and also to different categories of authorisation. The three basic options are shown in figure 3.

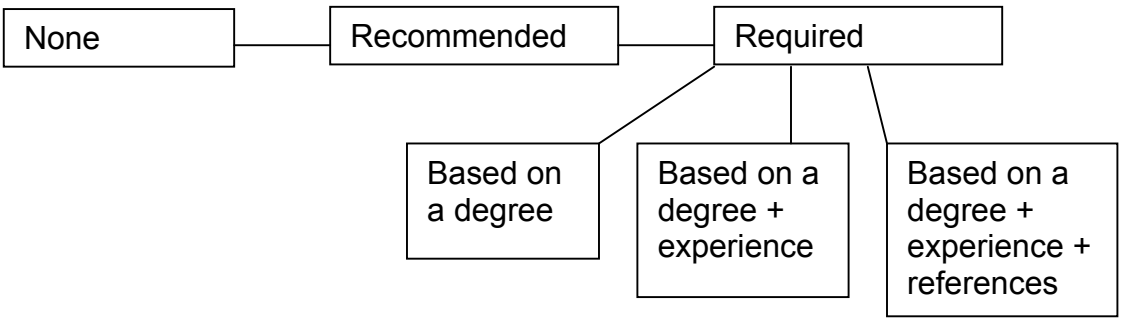


Figure 3. The basic options for pre-qualification for energy auditor training

No requirements

No requirements is the easiest choice but mean that the auditor candidates coming to the training will have very different backgrounds and knowledge. Arranging training to a heterogeneous group is challenging - even when the basic education is similar but only the level of experience varies. Persons with different technical background and expertise cannot be trained to do good energy audits – only in theory maybe, but in real life there is a limit to the length of the training course. Without any recommendations there will also be people participating the training course who have more or less just over-estimated their capabilities to do energy audits.

Recommended pre-qualification

Recommended pre-qualification is really just a recommendation and more like a message to the auditor candidates on the basic skills needed for the work. This is still an easy approach from the OA's point of view. The recommendation can concern both basic education and working experience.

In both this and the previous "no requirements" option, part of the trainees will no doubt be unable to provide good energy audits, probably not even a satisfactory level of work. Therefore the OA needs to have some other ways of ensuring the auditors' competence. One way is to include a test, which needs to be passed before an permit for auditing is given. If the test is strict enough, it will ensure that the theoretical knowledge exists. Whether the practical skills are good enough will be seen only after the first real audit (including field work and reporting) has been made.

Required pre-qualification

Required pre-qualification is the heaviest option for the OA, but it will definitely bring several benefits later on. In "required pre-qualification" option there is always an application procedure involved. The OA needs resources to handle the applications e.g. to check that all applicants fulfil the set requirements and possibly to some extent to ensure that the information presented in the applications is valid. The heavier the requirements are, the more work is needed. The basic education can be proved by an official document but as soon as project references are asked, the OA has to set some criteria and also decide if this information is just filed or analysed and possibly also verified.

The information may be given by the applicant himself or his employer. Personal references are more difficult to verify and one might assume that applications officially signed by the company are more trustworthy, due to more serious consequences in case of giving misleading information. Still, the information is quite difficult to check, e.g. on paper a person may have been involved in several energy audit projects, but what has his role exactly been – a project manager not really involved in the work, an assisting auditor responsible only for some routines or really the person whose skills have made the good audit report possible?

There is also always the question of the need and possibility for exceptions - e.g. what to do with an applicant with several years of experience and good references but no required degree? The easy option would be to stick to the set requirements but would it in this case be a good and fair one?

3.4 Content of training

The content of the training in connected both to the aims of the planned energy auditing activity and the skills of the energy auditor candidates. Based on the adequate overlapping of these two, the OA needs to decide what kind of training is really required. Like in many other areas, there is an easy option with reasonably light administration and an option where the output is more complete but where there is a significant difference in the required resources. The three basic options are shown in figure 4.

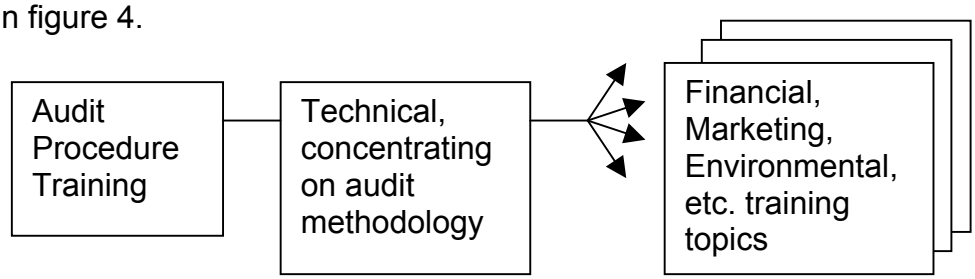


Figure 4. The basic options for the content of energy auditor training

In the first two options the training is directly connected to the energy auditing work. The third alternative widens the content to other topics, of which some (e.g. marketing) might be still connected to energy audits only, but some topics are already out of the scope of clean-cut energy audits. The third option is a natural choice if the energy audits are just part of a wider scheme with an aim wider than saving energy only.

Audit procedure training

The idea of procedure training is to explain how existing technical skills should be applied when working on an energy audit project. Energy auditing is a quite demanding working method and it has been observed that mechanical and electrical engineers tend to stick to the old working habits: looking for malfunctioning systems just from the technical point of view. There is a need (and also a possibility) to teach a totally new viewpoint – what should be done in order to decrease energy consumption and improve energy efficiency.

This option can be recommended if the energy auditor candidates in general have the adequate basic skills – adequate in reference to the selected energy audit models and defined target sectors.

Technical training

The technical training on audit methodology may be carried out as theoretical training (in a classroom) or also as practical training (including field work and measurements at a test site). The duration of this kind of training can vary a lot but a minimum amount of time will in practice be one to two weeks. If practical training is to be of some meaning, significantly more time and a good test facility are needed. The trainees must be divided into small groups of 3 to 6 persons, which will naturally have a clear effect to the need of training staff.

Other topics

The OA needs to decide if the auditors need training in other topics than energy auditing. In a clean-cut energy audit programme there is always a question of how far it is possible and reasonable to go without becoming a general training organiser, probably stepping on the toes of the professional training organisers providing equal courses in the market. One should also ask if it is the OA's responsibility to improve the auditors' marketing skills or should that be left to the auditor companies themselves.

3.5 Indication of auditor's competence

If the OA really wants to make sure that a certain level of competence exists, a method for the indication of auditors' competence needs to be defined. Defining the required level itself is a separate issue, to be kept in mind when planning the whole training in connection with authorisation and quality control.

The "indication of competence" should be seen from two directions: It is one way the OA can set standards but it will also be visible to the clients. Everyone who has a driver's licence is expected to be able to drive a car. If a method on auditor's competence exists, the clients will equally expect to see "comprehensive driving skills". Unfortunately with energy audits it is not enough to just "get it moving" – one should actually be able to participate in a car race. In this way the indication method is a two-edged sword.

The OA can also arrange tests for the applicants with certain pre-qualifications or even without any pre-qualifications. In this sense the indication of auditor's competence is not necessarily connected to a mandatory training course.

One question is the status of the indication. Will the auditors receive a document or a certificate after the test has been passed and what is the status of the document – is it just a paper or an official pass to the market - in which case there is a direct connection to authorisation. If it is an official paper, there should also be a clear procedure how the existence of the "driving licence" is verified, some criteria on the validity or the expiry date and for possible updates.

The basic options how to indicate the auditor's competence are presented in figure 5.

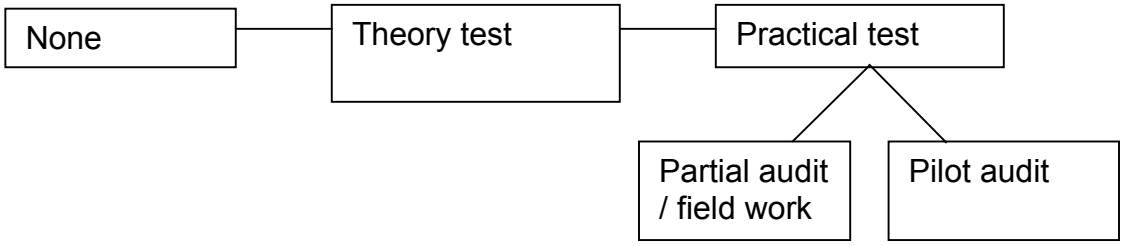


Figure 5. Basic option for indication of the auditor's competence

Theory test

A theory test is a light option to indicate the auditor's competence. How well it works is a question of how demanding the test is. In principle it is possible to develop a test which will separate those with adequate theoretical knowledge from those who don't have it. In any case the test should be developed by persons with real and comprehensive knowledge on energy auditing.

There are two ways of implementing the theory test. It can be arranged in a controlled environment like tests are normally arranged. The other option is to have it done by the trainees after the training course as a homework type exam. In comparison to a practical test both these option are light.

If these two types of theory test are compared, the first option is definitely more reliable. In the first option it is really the trainee whose knowledge is being tested. But based on experience the homework type of exam is not so unreliable as one might think. Most of the auditor companies really want their employees to pass the test by themselves without any help from other auditors, but naturally there are always some companies where one passed exam is just circulated and copied. This copying problem can be avoided by introducing exams with personal questions and yearly updated changes in questions.

The benefit of the homework type exam is the really light administration. It is also cheap from the trainees' point of view because they don't have to spend another working day to get the test done but can do it when it best suits them. One way to decrease the amount of work from the OA's point of view, if a controlled environment is required, is to subcontract all arrangements to a professional training organisation.

It would, of course, be practical to arrange the test in connection with the training course. One question here is the maximum length of the training course, can one additional day be included? Another question is, if the trainees have really digested the presented topics and are able to take the test right after the probably quite intensive training session.

Practical test

The idea of the practical test is to ensure that in addition to the theoretical knowledge the auditor can also perform in the field. In principle the practical test can be arranged so that a real audit (or at least some part of it) is done in a test facility during the training course. Another possibility is that a separate pilot audit with full reporting is required before the indication of competence is accepted.

Because a complete energy audit takes several days at the minimum even in a small building, a pilot audit is not really on option as an integral part of the training course. Even in a pilot audit there are some problems: how can the OA ensure that it is really the trainee who has done the work and if the used audit models require more than one person to be involved in the work, how the trainee's individual performance is separated and evaluated.

These problems arise if the indication of competence concerns an auditor in person. If the indication concerns the company, it is up to the company to arrange skilled personnel for the audit work and the OA is interested only in receiving one good energy audit report.

3.6 Organiser of training

There are three basic options how to organise the auditor training. The principle difference in the options is the part of the work the OA is responsible for. The decision on the option is more likely to be based on the OA's available resources than other criteria. The options are shown in figure 6.

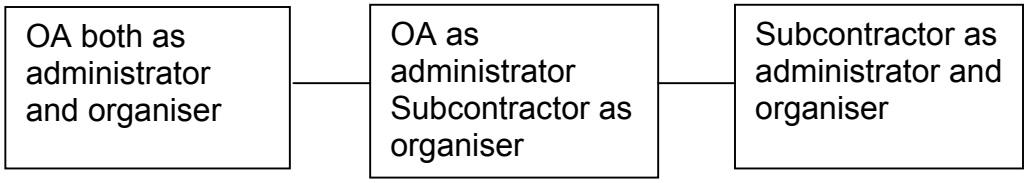


Figure 6. The basic options on the organiser of the auditor training

OA as the administrator and the organiser

In this option the OA is responsible for all arrangements concerning the training. The lecturers, who in any case need to be real EA experts, can be from outside the OA's own staff. It is difficult to see that the OA's own staff would have such a comprehensive expertise in energy auditing that all aspects of the training could be covered.

Organising a training course requires some experience. If no previous experience exists, the first courses will be interesting. The good point in this option is that everything about the training is in the hands of the OA. Also the amount of work needed in comparison to the following option is higher but the commission paid to the subcontractor easily covers the increased honoraria cost.

OA as the administrator

If the OA does not have the resources to organise the training, this part of the work can easily be subcontracted to a professional training organisation. The OA still owns all rights to the course and can e.g. decide on the content as well as on the lecturers and their fees.

If the responsibilities are divided between the OA and a subcontractor, it is important that the contract clearly specifies the roles and the fees. For example: the subcontractor may not be interested in marketing the course if additional participants do not increase the profit respectively.

Subcontractor as the administrator and the organiser

If the training is voluntary and/or recommended, the OA can subcontract the whole training activity. The problem with subcontracting is that the more the OA subcontracts, the less the OA can control the training – or bothers to control it.

3.7 Cost of training

The cost of training has three aspects. The level of cost should be reasonable for the auditors and also in ratio to the expected volume of business and profits. At some level the cost will start reducing the interest to participate the training. On the other hand, the cost should be high enough to keep those out who are not seriously interested in entering the audit business. The result of a too low fee might also be that the auditors do not take the training seriously.

The third aspect is the profitability of the training itself – should it bring profit, should it be just self-financing or can it be subsided? A market price for the training is the level a professional training organisation would define for it. This is a good reference when setting the level for the course fee. If the fee is higher, there will be the question of the OA unfairly taking advantage of the situation.

If there are no professional training organisations with equal commercial courses, the OA has more or less a free field to operate. If equal training exists, there is a risk of market disturbance – which may cause other kind of problems.

The expenditure of arranging the training varies depending on the status of the training but also on how it is arranged. Voluntary and recommended training needs to be marketed, which can significantly increase the total expenditure. Mandatory training requires only disseminating information on the dates and places.

The low cost option is to have the training arranged by the OA and the high cost option is to subcontract it to a professional training organisation. Subcontracting this kind of training normally requires a competition arranged between a couple of these organisations. Subcontracting will of course reduce the amount of work needed from the OA and in this respect it is an easy “let the market take care of it” option.

If there is a need for a low training course fee and the training cannot be arranged without a subsidy, the OA should plan carefully in what form or way the subsidy is included.

One decision is the possible connection to authorisation or to the indication of auditor's competence. The OA needs to decide whether fees for these are included into the training course fee or if the fee for a test or for a certificate is charged separately.

3.8 Recommendations

In principle energy auditor training should always be one element in a programme level activity. As presented above there are several different ways of implementing it. The only way to have a well functioning training in place is to analyse thoroughly the situation. Not only analyse the training itself but also the other topics with connections to training and the aims of the whole energy audit activity. In parallel with this process the required resources and related costs should be estimated – something might look very good but it is too expensive or too complex for the OA to administrate. The planning process is a circle – or a group of circles actually because the training cannot be planned as stand alone activity.

A state-of-the-art training programme would be based on the following recipe:

- Mandatory - in order to make sure that non-professional auditors are not messing around
- Required pre-qualification – to ensure that the trainees have equal and adequate background knowledge and experience
- Technical training – to show how the existing expertise is to be applied in energy auditing
- Theory test – to give a permit to implement the first audit
- Practical test with a pilot audit – to give a full indication of the auditor's competence and leading to authorisation
- The OA should be at least the administrator of the training – in order to be able to continuously control and adjust the training process when necessary
- The cost for the training – high enough to keep the non-professionals out

And in order to continuously improve the performance the basic training should be strengthened by:

- Regular extension courses on special areas and related topics – on recommended basis and giving some edge in the market place to the participants
- Annual meetings where current issues can be discussed and feedback given – on mandatory basis

Whether this functions as a state-of-the-art programme and is at the same time also cost-effective depends of course on the size of the energy audit activity and on some country specific features. The state-of-the-art approach can be the aim but in practice compromises are unavoidable.

The size and intended duration of the energy audit programme has an effect to the training programme. It is clear that the smaller the size and shorter the duration of the programme, the less effort is worthwhile putting into the training. With large programmes with long duration the state-of-the-art recipe presented above is recommended.

One viewpoint is the required auditor competence versus the complexity of the buildings or sites to be audited within the programme. Some recommendations can be given based on following combinations.

- Auditors with similar knowledge and equal experience will be working on similar and simple sites – training can be light but definitely needed if the auditors are not all good.

- Small group of auditors with similar knowledge and equal experience will be working in different and complex sites – training does not really make sense and who could actually give it. Here a good solution is a seminar type of event where the general guidelines and aims of the audit programme will be presented. Whether this is defined as one option for authorisation or the lightest option for training is a matter of definition.

- Auditors with different levels of knowledge and background will be working on similar sites – real need for training and a good opportunity to make it effective.

- Auditors with different levels of knowledge and background will be working on different and complex sites – OA's nightmare and training really needed.

How energy auditor training is connected to the other elements of an energy audit programme is described in the table on the following page. The various elements of the audit programme should be analysed together when the main choices of each element have been made.

	Promotion	**EA Models**	**Quality control**	**Monitoring**
No training	Audit clients may not be convinced of auditors' skills. Auditors may do marketing using different material & arguments.	If several models, auditors will need good guidelines & other written material	Strict QC needed to eliminate quality problems	Auditors may produce insufficient data if the requirements for monitoring data are not clear
Voluntary training		Some auditors are better aware of model differences than others	Uneven quality is possible unless guidelines & other material is very good	
Recommended training				
Mandatory training	Signal to audit client of a permanent programme	Auditors are trained on the differences in models	QC may be lighter when auditors are aware of QC requirements	Requirements for monitoring needs easier to explain in training
Introduction	May not give enough data on marketing	Purpose & requirements of different models may remain unclear	Purpose & requirements of quality control may remain unclear	Purpose & requirements of monitoring may remain unclear
Procedure training	May not give enough data on marketing	Gives enough data on models	Gives enough data on quality control	Gives enough data on monitoring
Technical training		Gives enough data on models, maybe also testing in practice	Gives enough data on quality control, dealing with model reports	
Wide training	Gives enough data on marketing			
No test	Audit clients may not be convinced of auditors' skills.	No way of testing if auditors understand the differences of the models	No way of testing if auditors understand the meaning of quality guidelines	No way of testing if auditors understand the meaning & requirements of monitoring
Theory test	Knowledge on marketing material, information & procedures can be tested	Knowledge on models can be tested	Knowledge on QC requirements can be tested	Knowledge on monitoring & reporting requirements can be tested
Practical test				

4 Authorisation

4.1 General

Authorisation of an energy auditor is his “licence” to perform audits within the audit programme. The purpose of the authorisation can vary: It can be just a way to separate those who are allowed to do energy audits from those who are not – to set up a status for energy auditors. The other purpose is to ensure that only competent auditors are working within the programme; or to go even further - to set up a ranking system which is based on different levels of competence. In this way authorisation becomes connected to training or to pre-qualification and also to the energy audit models.

The authorisation may concern a person or a company or both. Although some of the options and choices apply to both, the viewpoint in the following is the authorisation for a person.

4.2 Basic choice

The first decision is whether to have authorisation for energy auditors or to have no authorisation. However, the OA has also a third option which is technically between these two. All three basic options with the sub-options are presented in figure 7.

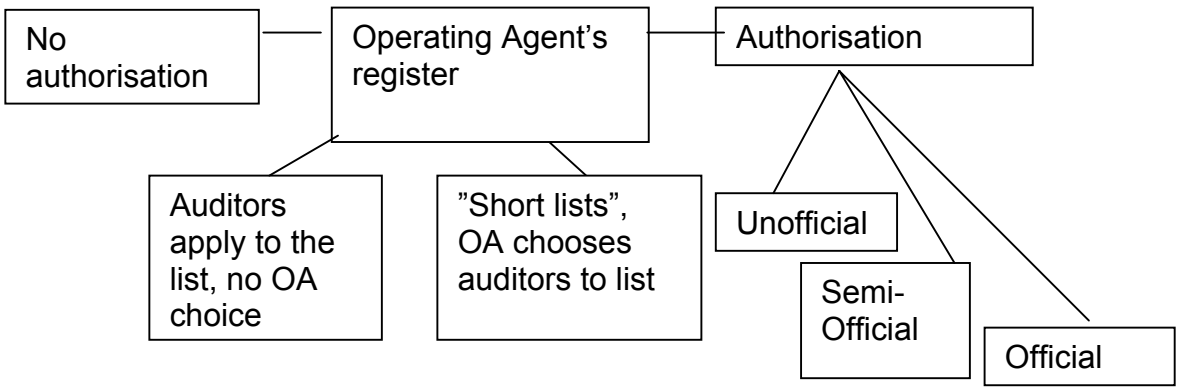


Figure 7. The basic options on authorisation

The OA’s register

The Operating Agent’s register is an option between actual authorisation and no authorisation. The register can be created in two ways:

- All auditors can apply and have their names on the list
- The OA chooses the auditors to the list according to some criteria.

The criteria to be used is up to the OA, but it may include e.g., auditors’ CVs, company references, financial information, client feedback etc. The list can also be based on a yearly updated tender with the valid consulting fees.

Authorisation

The main difference between the options is the legal authority of the authorising organisation to take such actions. The three options are:

- Unofficial authorisation
- Semi-official authorisation
- Official authorisation

Authorisation is unofficial when given by an association or an organisation representing a group of clients or e.g. the auditors. In these cases the authorisation criteria is defined by the association. The OA can also use an existing organisation of professionals (e.g. the association for mechanical engineers or the association for consulting companies), which exist in many countries and have recently started developing creditability to their members by introducing "certificates for professionalism". This option will also free the OA from the legal question of being really in position to restrict some companies or persons to enter the market. An unofficial authorisation is in practice just a strong recommendation. If this recommendation is not followed, the OA's possibilities to take actions is very limited.

The idea of the semi-official authorisation is that although the authorisation given is not official itself, it is accepted by the Administrator and the Administrator has set some official requirements which this semi-official authorisation fulfils. Furthermore, if it is significantly troublesome to fulfil these requirements or criteria by other means, the semi-official authorisation is in practice as effective as an official authorisation. The benefit of the semi-official authorisation is the freedom for the OA to choose how the authorisation is put into force and how it will be terminated.

An official authorisation is based on a law or a decree, and/or given by an officially certified body e.g. DNV, Lloyds etc. It is easy to understand the difference between an official authorisation and a semi-official authorisation by reading the instructions and requirements concerning e.g. persons who are auditing official standard based quality and environmental systems. Official authorisation is the most powerful way to authorise energy auditors and is recommended if energy auditing is mandatory. Official authorisation is also expensive to administrate in comparison to other options but this can be compensated by defining a higher authorisation fee for the auditors.

The authorisation can also be in the form of fulfilling a formality. If training is not needed or for other reasons it cannot be arranged, the easy way of taking care of this formality is to arrange an event where the principles of the energy auditing activity are introduced. The idea of "introduction to energy auditing" is to just to give a general picture of the intended outputs, not really to train anyone to do the work. Typically a one-day event will give the OA an opportunity to explain and justify both the wider framework and programme details. Written guidelines are needed but they are often differently interpreted. Following some guideline details might be of major importance from the OA's point of view and with some other issues more freedom can be allowed. It is always more effective if these questions can be discussed face-to-face with the auditors. This will decrease the number of problems to be dealt with afterwards in the quality control.

This option is recommended if the programme or scheme will be light in all other aspects. This option can be used also without the authorisation purpose.

The OA can also introduce pre-qualification requirements for the authorisation as well as for training. These requirements can be based on basic education or on working experience or on both. Even if the pre-qualification can benefit the whole activity, it might exclude some skilled and potential auditors. Therefore the OA should not define the criteria so tightly that common sense cannot be applied.

4.3 Validity of authorisation

There are two main points concerning the validity of authorisation, both needing careful analysing before decision-making. These main points are:

- Duration of validity
- Area of validity

Duration of validity

The authorisation may be valid for a limited time or forever. The duration of the authorisation should be considered in connection to the quality control and training.

If the authorisation is permanent, the auditors will never be automatically removed from the market. The OA always needs to take some action if a removal is needed. Therefore, with permanent authorisation, the OA should have a clear process how to freeze or cancel the authorisation of those auditors who are not able to perform and provide good quality of work. Permanent authorisation is the light option but cannot be recommended without a strict quality control system. However, if the OA does not have resources to administrate a continuously or regularly updated authorisation system, the permanent authorisation may be the only option.

The authorisation valid for a limited time can be arranged in several ways. One way is to connect it to active operation in the market, e.g. a two-year period without reported and accepted audits will automatically terminate the authorisation. Equally a connection to the participation to a yearly training can be considered as a condition for authorisation.

One way which requires activity from the auditors' side is to connect the duration of the authorisation to a yearly fee. The auditors or companies have to pay yearly to maintain the authorisation. This will automatically remove those who are not seriously involved in the business. This non-active group is always a bit of a problem, because they are not a real resource for the OA, their experience is not improving and furthermore, just the existence of this group may increase the OA's expenses. The yearly fee can be used to compensate the cost of running the continuous authorisation process.

Area of validity

The area of validity defines the kind of auditing work the auditor may do or what kind of projects he may be involved in. There are several options the OA can choose from – all with “pros and cons”. The four basic options are shown in Figure 8.

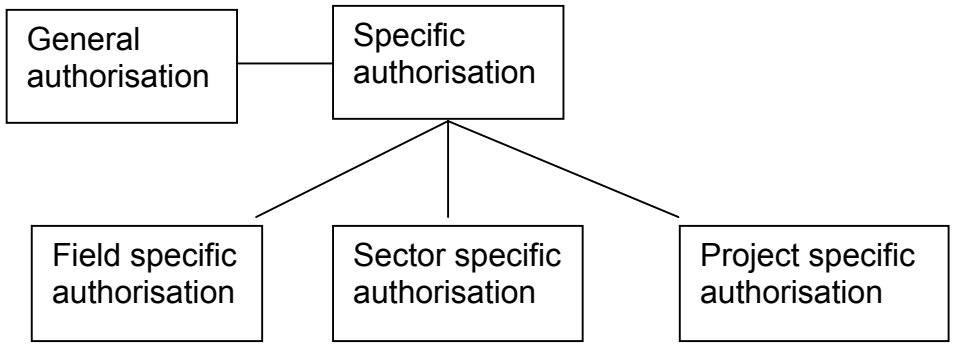


Figure 8. The alternatives on the area of validity of the authorisation

General authorisation

The general authorisation means that there are no restrictions on the auditors’ work: all authorised auditors are allowed to do whatever auditing work in all kinds of projects without any limitations. From the OA’s point of view a general authorisation is a light option but technically it is difficult to see that one person could properly cover all areas needed.

If the idea of the general authorisation is only to appoint project managers (possibly with some pre-qualification) who are responsible for the audit so that it meets the guidelines, the option is applicable. But then it will be up to the quality controller to see that all technical areas have been adequately covered in the EA reports.

Specific authorisations

There are three different types of specific authorisations: field-specific authorisation, sector-specific authorisation and project-specific authorisation.

The field-specific authorisation allows the auditor to work in a certain authorisation area, for example as a mechanical or an electrical auditor. This decision is connected to the audit models in use. In principle the idea of a field-specific authorisation is to have all important and potential areas covered from the technical point of view. This is a country specific question depending on the technical education system and the auditors’ background in the country. The practical work can still be divided so that e.g. some routine work is carried out by junior personnel but under the supervision of an authorised (and hopefully an experienced) senior field expert.

The sector-specific authorisation may be a good option to ensure that only competent auditors work in more complex projects. A rough division may be between auditors working in service sectors and those working in industry, where the differences in required skills is clear. There can also be limitations concerning e.g. SME's and process industry. The division can be further continued to sectors and sub-sectors e.g. pulp and paper, basic metals, petrochemical etc. In practice the process industry is quite selective itself and it is not a real risk that persons without any knowledge on the sector would be allowed to start messing with the processes. But from the OA's point of view, the more different levels of auditors the programme includes, the more complex and laborious it is to administrate. Although the sector-specific authorisation would definitely ensure that real sector expertise is involved, there will at some point be a problem with the OA's own experience and knowledge – is the OA competent enough to set any standards to some sectors?

The project-specific authorisation requires a lot of work from the OA if the authorisations are granted individually for each project. One possibility to use this type of limited authorisation is to authorise the site staff to audit their own site or the company personnel to audit the sites owned by their company. Project-specific authorisation could also be used to authorise a project team, not just individual auditors. Typically in the process industry the energy audits are always carried out by a team of experts. By authorising a team the OA could ensure that all expertise needed for the work is included.

4.4 Cost for authorisation

Defining a cost for the authorisation is one way for the Operating Agent to cover the cost of the services provided to the auditors. It is also a way to ensure that only those companies and auditors that really are interested in the work are participating. The cost for authorisation is tightly connected to the cost for training and therefore in the following options also training is presented. The point of view taken, however, is authorisation. The different alternatives of authorisation costs are shown in Figure 9.

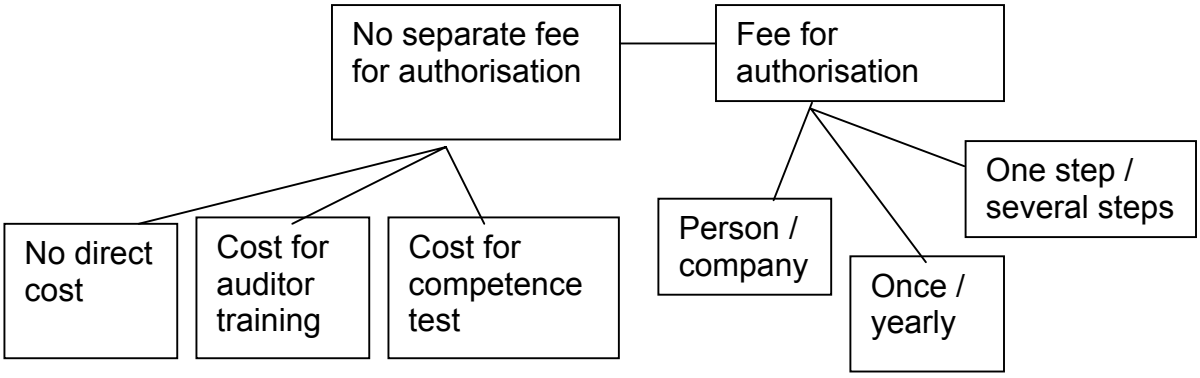


Figure 9. The basic options on the cost for authorisation

No separate fee for authorisation itself is an option but also then equal aims of covering the OA's expenses (at least partly) and limiting the number of entering companies (and auditors) can be achieved. If there is a separate fee for authorisation there are a few aspects to be considered or taken into account.

In principle the level of the fee should be in a reasonable ratio to the business opportunities it will bring along. If the idea of the fee is more to limit the number of authorised companies (or auditors) to those only that are seriously involved in the business, the fee should be quite reasonable. The other option is to have the aim of covering the OA's expenses partly or totally. In this case the fee will evidently be significantly higher and this will bring along one other question: the range of services for auditors provided by the OA.

One question is also the re-authorisation. There are several ways or mechanisms how the authorisation is either automatically terminated or cancelled by the OA. In these cases there is always the question of how the authorisation can be activated and on what cost.

Cost per person or per company

An authorisation fee for a company can naturally be higher than a fee per person, although the auditors' employer will normally pay the fees. If the number of persons to be authorised is expected to be high, the collected cumulative personal fee might lead to a higher sum than the company authorisation. Whether this is financially a better option depends on how much the OA's expenses increase relatively. However, the profit coming from the authorisation process should not be guiding the OA in the decision making. The goal should always be the performance of the programme.

There is also on option to have a combination of a fee for the company and separate fees per each auditor within the company.

One fee or annual fees

Between these options the major difference is the continuous cash flow to the OA, which is necessary if services are provided for the auditors. On the other hand, annual fees are also automatically dropping the non-active auditors from the market. The passive auditors can create a problem to the OA, because they are not continuously following e.g. the changes in guidelines and when they randomly implement energy audits the ability to come out with good audits can be questioned.

One step or several steps

If the OA has introduced an approach where there are different levels of authorisation, it is natural that each level has a separate fee. Whether the amount of these fees is different for the different steps, is a question of the difference in the expected business opportunities opened by each upgrading level.

4.5 Connections to authorisation

Many countries have different requirements for certificates and permits for persons or companies implementing work, which is typically needed in an energy audit. The two basic areas where this kind of requirements are normally set are:

- Consulting and project management
  - Project manager certificate
  - Professional engineer certificate
- Field work
  - Permit for electrical measurements (working safety)
  - Certified electrician, certified boiler inspector etc.

There may also be scheme-specific authorisations connected to other schemes - energy related, environment related, building services related, etc. It is not necessary to develop a totally new and independent system for an energy audit programme. Although the existing systems are probably just slightly overlapping with the OA's needs, it might be cost effective to take advantage of some of them.

However, in order to be able to clearly inform the auditors on the conditions and rules of how the auditing work can be done, the OA must be aware of all mandatory certificates and permits in the country. The main points the OA should know are:

- What kind of authorisations exist
- What the authorisations include
- Who grants the authorisations

Although there aren't any known cases where an energy auditor has actually died during field work, there are several cases where it has been a very close call – even with experienced and certified electrical engineers.

4.6 Recommendations

The authorisation of energy auditors is one way to ensure that the non-professionals can be kept out from the serious business. Therefore, if the energy audit activity has a real meaning, some level of authorisation should be introduced. The options are in practice:

- OA's register, a short list of companies based on strict selection criteria
- Authorisation

There isn't a significant difference in practice whether the authorisation is official, semi-official or unofficial. This choice depends more on the nature of the energy audit activity.

The validity of the authorisation should always be limited to a certain period of time. This will be very important in order to automatically keep the number of auditors limited to only those who are active in the business but also to set a point where the authorisation will automatically terminate.

The area of validity should also be limited so that a combination of adequate expertise is achieved. A general authorisation, if the idea is authorise project managers, is not a bad option but then there should be clear and strict conditions on the use of other personnel in the audit work.

A state-of-the-art authorisation would be based on the following recipe:

- Semi-official authorisation of persons combined with the OA's register on selected and short-listed companies
- Validity of authorisation limited to a maximum of two years and the OA's register updated annually
- Area of validity restricted according to technical basic education and according to the complexity of work, e.g. residential, service and industrial sectors requiring separate licence - general authorisation for project managers as optional and on voluntary basis
- Annual fees for companies (medium cost) and one fixed fee (medium cost) for authorised auditors or as an option an annual fee also (low cost)
- Other existing authorisations which are needed for the work clearly specified and presented as a pre-condition for the energy auditor authorisation

The authorisation should also be strengthened by:

- Clear rules of conduct as well as a procedure in case of misconduct, meaning the cancellation of the authorisation
- OA's legal position secured so that all taken actions concerning the authorisation will hold if taken to court

In comparison to training, the authorisation does not so much depend on the magnitude of the energy audit activity. Authorisation can be arranged also in small programmes with a short duration. The main point is the real need for control and steering.

How energy auditor authorisation is connected to the other elements of an energy audit programme is described in the table on the following page.

	Promotion	**EA Models**	**Quality control**	**Monitoring**
No authorisation	Clients will not be able to separate good auditors from poor ones	New models will be difficult to introduce to an undefined group of auditors	Strict quality control is needed if no authorisation exists	
Operating Agent's register	Clients get the information on active auditors	A clear target group exists, new models easier to introduce	Poor work will expel auditors from the list, strict quality control needed	
Authorisation	Clients know who are the professionals in the business	A well-known target group exists, new models easier to introduce	Quality control may be lighter if tight authorisation requirements limit the auditors to real professionals	A well-known target group exists, new monitoring requirements easier to introduce
Duration of validity is limited	Only the auditors with the latest information and recent experience are doing the business	The active auditors are known - important when new models are introduced	Quality control may be lighter if tight limitations expel non-actives from the market	Changes in required monitoring data may be easier to introduce when all auditors must have updated information (e.g. yearly training)
General authorisation	Generalists available	Model development should take this into account - all auditors are generalists	Strict quality control is needed, all auditors are generalists	
Specific authorisation	Sector specialists available	Model development can go into details of work + introduce model-specific training	Work of quality controller is lighter if auditors have area-, sector- and model-specific knowledge	Sector-specific requirements on monitoring data are easier to introduce

5 Quality control

5.1 General

Quality control in an EAP means that the auditors' work is checked - somehow by somebody. There are numerous ways of implementing the quality control. Depending on the OA's choice, the actual effect and also the required resources vary. Therefore the choices concerning quality control should be based on the following questions:

- What is the aim of the quality control
- What are the resources available for the quality control

One concrete example is Finland's Energy Audit Programme where "the existence of the quality control system ensures that a certain quality level of the audits is generally achieved". So the idea is not to find and punish every "speeding driver" but the fact that "speed is controlled" and "a fine defined" will make all law-abiding citizens follow the speed limits. Some campaign type actions every now and then can be used to enforce the effect.

One viewpoint to the quality control procedure (being realistic with the resources) is that the aim should be in avoiding real quality problems during the life span of the energy audit programme - and not in having the best possible quality in all audits.

The aim of the quality control – some view points to be taken into account when planning the approach.

- Ensuring that the guidelines are obeyed
- Laying the basis for uniform quality of audit work
- Ensuring that the clients get what they pay for
- Creating general creditability
- Giving feedback to the auditors
- Receiving feedback for auditor training

It is more than likely that the quality control will not be appreciated by any of the auditors in the beginning of the programme. But the longer the programme has been running the better the good auditors understand the benefits of strict quality control. The quality of work is connected to the cost of the audit. In the long run the quality control will be seen as a guarantee for the good auditors that the competition for projects is fair – equal output is required. The clients often see the quality control as a guarantee for quality of all audits. Depending on the option taken by the OA, this can also create unrealistic expectations on the accuracy and comprehensiveness of the quality control system.

5.2 Basic choice: method of quality control

The first choice for the Operating Agent is to decide if there is quality control or not, and if there is, what is the method to be used. The basic choices are shown in Figure 10.

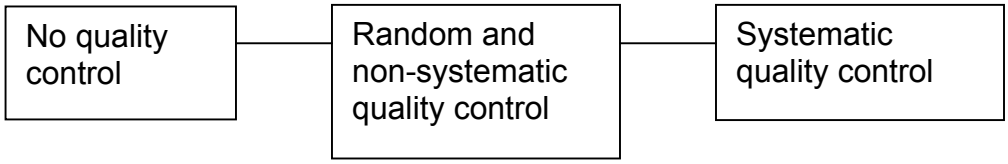


Figure 10. The basic options on quality control

No quality control

This choice means that it is totally up to the clients to decide what quality level is acceptable. Based on experience very few clients can really evaluate whether the output of the work is good, satisfactory or poor. Based on the Finnish experience some clients have been quite satisfied with an audit although the official quality control system rates the report “not acceptable”. Most of the clients order energy audits only once (or just a few times) which means that they never actually develop quality control expertise of their own. This is a serious problem because some of the audit projects are very large in size and cost. If the quality is poor, the money is more or less totally wasted.

It is really difficult to see that a good energy audit programme could be run without a quality control system.

Random quality control

The random quality control means that it is not a systematic activity. The quality control procedure is in this case triggered by an internal or external impulse. The most common impulses are:

- Client complaint of auditor’s work
- Another auditor’s complaint (“squealing”)
- The Administrator or the OA is just curious to go through some reports
- The report is so far from the expected that it is evident that it cannot fulfil the requirements (instead of expected 40 pages only 4 pages are reported)

Systematic quality control

The systematic quality control means that the OA has a pre-defined procedure how the quality control is carried out. Systematic quality control does not automatically mean that the taken approach would be good and efficient. The OA still has several methods to choose from and there is also the question of being able to really follow the procedure. In comparison to the random quality control, the systematic approach has some clear benefits:

- The existence itself will have an effect to the general quality of audits
- Required resources can be estimated in advance
- All reports (and auditors) are treated equally

The viewpoint in the following chapters is the systematic quality control, although these principles can be applied also in the random approach.

Control based on energy audit reports or actual work on site

One basic choice for the OA is to decide whether the quality control is based on the submitted reports or if it includes also site visits. Checking energy audit reports is always recommended as the main method for quality control. If the work is done by an experienced energy auditor, the quality can be evaluated quite well by just checking the reports. But here is also a connection to the energy audit models in use. If Administrator's guidelines are very general and allow free format reporting, the quality control work can be quite troublesome. The more freedom the auditors have when deciding on site what to do and what to leave out, the more problematic it is to evaluate afterwards whether these decisions were proper or not.

Onsite quality control of energy audits cannot be really used as the main option, because of the significant cost related to this option. Although the quality control audit can be restricted to one or some of the systems instead of the whole building or site, the cost will easily be 10-50 times the cost of checking just the report. Another question is the implementing body - does the OA have enough resources (in man-days as well as in expertise) to carry out quality control audits. If the work is subcontracted to another auditor, there will be a question whether the control audit can be used as evidence in case of a dispute on the outcome.

The quality control audit can be used as a tool to state a clear case when the quality of one individual energy audit report is really poor. Another question is whether the OA needs quality control audits as basis for corrective measures - or just to see how well the work is done in general (when the control audit is an action of random quality control).

It is necessary to point out here that the evaluation, implemented at the programme level, does not substitute the project-specific quality control – in practice the work might have similarities but the aim and the viewpoint are totally different.

The different options for implementing a quality control audit are not presented in detail in this report. The following chapters deal with the checking of energy audit reports.

5.2.1 Coverage and criteria of quality control

One decision in the systematic quality control is the percentage of checked energy audits. The Operating Agent can set a target for the coverage so that e.g. 25% of all reports are checked. The coverage can also vary within a programme depending on the used audit models, size of project, etc. The coverage can also be higher in the beginning of the programme and then later, when a certain level of quality has been achieved, the coverage is lowered. A 100% coverage is of course the only way to ensure that all reports are good, but it requires a lot of resources and in the long run is not very cost effective.

Usually the existence of systematic quality control is enough to maintain the quality at a reasonable level. As long as there is continuous feedback to the auditors, the majority of them will try to follow the guidelines as well as possible.

The OA can (and should) have clear criteria on how to choose energy audit reports for quality control instead of just randomly picking every fifth or tenth report. With pre-defined criteria, the chances of finding those with the highest probability for poor quality are the best. The criteria may include the following internal impulses:

- New auditor submitting reports for the first time
- New client with a large number of audit sites coming up later
- Exceptionally large project
- Technically difficult site (process industry, unusual service sector site)
- New audit model being reported for the first time
- Auditor with quality problems in previous projects

There are also the two external impulses when the quality control process needs to be activated: The client can request for quality control when he is not sure of the quality of an individual report or he wants to make sure that the first reports of a large project are good enough to proceed in the same manner with the rest. Also the auditors may want to ensure in advance that their level of quality will be satisfactory by sending the first reports for a pre-quality control – before continuing with the rest, maybe 50 buildings.

5.2.2 Thoroughness of quality control

The thoroughness of the quality control means the different levels of checking the reports - what issues in the report are checked. Figure 11 illustrates the available basic options.

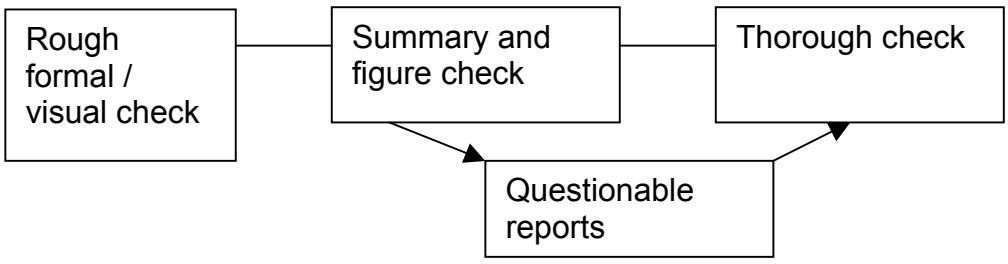


Figure 11. The basic options on the thoroughness of systematic quality control

Rough visual check

The rough visual check is based on just leafing through the report. The idea of this option is to confirm that the guidelines concerning the format of the report are fulfilled. This option does not involve any checking of technical details or presented figures. A rough visual check can be done by personnel who are not highly familiar with energy auditing. This could be considered the lightest possible option to be used when subsidies are involved and it is necessary to have some evidence that the subsidy is payable. This option will not guarantee by any means that the information presented in the report has some value – that is left for the client to decide.

Summary and figure check

The summary and figure check concentrates on the following issues:

- The saving potential is on a plausible level
- The proposed measures are realistic for the building type in concern
- The data to be fed into the monitoring system is logical (building volumes, energy consumption figures, etc match)

The summary and figure check can be used as the first step in a method of two-phase checking. In the first phase all reports have a summary and figure check and those with clear irregularity will be chosen for a thorough check. It is still quite easy to see if the presented figures are at normal range by using e.g. specific energy consumption and other reference data for comparisons. Defining the viability of the proposed measures already requires more experience.

Thorough check

The thorough check needs a skilled quality controller, preferably someone who has been involved in audit projects himself. The thorough check includes:

- Checking the content of the report from the technical point of view
- Checking the technical specification of the saving measures
- Verification of the level of the presented saving potentials (how the savings have been calculated)
- Evaluating the knowledge and reporting skills of the auditor in general

This option is something that the clients more or less expect to be done if a quality control process is run by the OA. This option will improve significantly the total performance of a programme level activity. At least some of the auditors that are not performing well are not doing it intentionally. The thorough check option can also have an effective training function but also make some auditors understand that their skills might not be really adequate for this type of work. The thorough check is also the only recommendable option if the OA plans to give grades or scoring points to reports - or by other means classify the auditors. Compared to the other options the thorough check requires much more resources.

One reason to the increased amount of work is the fact that the opportunity to give feedback to the auditors will quite certainly be utilised. And the feedback means that sometimes also corrective actions must be taken. Still, the quality control is one area where the cost effectiveness of the “heavy” option can easily be shown.

5.3 Tools of quality control

The OA can utilise various tools in the quality control process. The tools can be used to ease some routines but also to standardise the process itself. The following list presents the different tools in use.

- Computer-based figure-checking
- Checklists
- Self evaluation forms for auditors
- Audit client questionnaires
- Auditor feedback

Computer-based figure-checking

The energy audit reports contain a lot of numerical data. Using key figures on e.g. specific energy consumption and energy prices, the OA can automatically check the correct range and amount of the data. This is normally done when the data is fed into the OA’s database. Although this cannot be used as the only tool, it will improve the creditability of the database and the monitoring of the energy audit programme.

Checklists

A checklist for the quality control procedure of an individual energy audit report is useful especially if there are several persons doing the work. It will ensure that all reports are checked using the same criteria and it also enables a scoring system to be used. Different lists might be required for different audit models. A checklist is a good combination with the computer-based figure-checking.

Self evaluation forms for auditors

A checklist can also be used for self-evaluation. This quality control checklist is filled in by the auditor himself and can be attached to the report before sending it to the OA. The idea is not to eliminate the need for OA's quality control but the self-evaluation can reduce the need for thorough and covering quality control in the long run. An internal quality control procedure is also a very good practice for companies implementing energy audits.

Audit client questionnaires

Feedback from the client is always valuable although it does not give reliable feedback on the auditor's skills. Very few clients are professionals in energy auditing and therefore their opinions on the technical competence of the auditor may vary. On the other hand, when the auditors know that there will be a direct feedback from the client to the OA, it makes sure that good service is provided.

Auditor feedback

In a way also the feedback to and from the auditors can be seen as a tool. Obviously the best and the most efficient form of feedback is a face-to-face meeting between the quality controller and the auditor. But these meetings are normally used only in serious quality problem cases or when the auditor will launch energy audits in large numbers.

The OA's web-site may have a FAQ element dealing also with quality questions. If the number of auditors is big enough, also auditor newsletters or magazines can be introduced. The lightest option to give feedback to auditors is to connect it to annual seminars, updating training etc.

5.4 Cost of quality control

One of the key questions connected to quality control is the total cost of it and who will be directly responsible for the financing. Another question is the principle of how the financing is arranged in practice and how the money flow finally goes. The basic options for financing the quality control are:

- The Administrator
- The Operating Agent
- The Clients
- The Auditors
- A combination of the above

The Administrator or the OA

The easy solution is, if the OA is receiving funding from the Administrator, to include the basic quality control work to the general administration budget of the energy audit programme. Whether the OA can be seen as the financier of the quality control at all, depends on the overall structure of the OA's and the Administrators activities and the relation between these organisations.

The Clients

With the clients being responsible for the cost of the quality control there will be an invoicing problem. The control fee cannot be fixed because the amount of work varies depending on the size of the project and this would be too heavy for the small projects. If the size of the project is taken into account the fees for small projects might not even cover the invoicing costs.

The Auditors

The Operating Agent can also raise at least a part of the costs of quality control from the auditors. A separate control fee per energy audit project might bring too much administrative work but if the auditors pay an annual authorisation fee, the cost for quality control can easily be bundled into it. An invoice per project would also make it easier to transfer the cost directly to the client in concern. As an annual payment it is more likely to be a part of the overhead expenses of the auditor company.

In any case it would be good to invoice the extra work (e.g. for a second round of quality control of a poor project) from the auditor in concern. This will ensure that there will be a serious attempt to submit reports that will pass the control process. Whether these extra costs can be invoiced 100 % is another question. E.g. if a quality control audit is needed and implemented, the charge could be close to the original fee for the energy audit project itself. Therefore this "fine" should be either a fixed fee or in some reasonable ratio to the size of the energy audit.

The combination

If a combination of the different alternatives explained above is chosen, the main question is the way of covering the OA's expenses in general and in which ratio specifically these cost are collected from the key players. The decision should take into account the cost-effectiveness and the available steering effect of a reasonable fine.

5.5 Performer of quality control

Depending on the approach, quality control can be lot of work by competent people. The competence involves auditing skills, technical skills and also the knowledge on auditing guidelines. The meaning of quality control is totally lost if the comments given to the auditors are technically false or otherwise irrelevant.

When deciding on the performer of the quality control there are at least the following points that need to be taken into account.

- The neutrality and credibility issue
- Resources in ratio to the expected amount of work, both in the total amount but also in the ability to meet reasonable deadlines
- Technical expertise

Based on this criteria the four candidates for the performer of the quality control are

- The Administrator
- The Operating Agent
- A Consultant or a team of consultants
- The Client

The Administrator

The Administrator is often a government body and in most cases just a theoretical option. It is not common to have the sufficient availability on both personnel and specific expertise on energy auditing. The Administrator can, however, participate in the quality control process at least if the Administrator is responsible for the payment of subsidies. To be able to pay the subsidy the Administrator needs to check all financial numbers as well as some administrative information. Even if this control cannot be thorough, it can be the first rough control taking care of e.g. that reports are correct in number, the applied energy audit model is correct and that the appearance of the report is according to the guidelines.

The Operating Agent

The OA is, or at least it should be, a neutral body. This allows the OA to have access to all information presented in the audit reports. This information can be in some cases strictly confidential, e.g. when the process industry is in concern,. The OA is also a neutral body from the auditors' point of view, which allows objective comparison between different auditors. The main question is the technical competence of the OA's staff. Whether this exists and the resources are adequate,

the OA is a good option as the performer of quality control. Some of the work can be subcontracted to consultants but there is always the requirement of strict neutrality and credibility.

A Consultant or team of consultants

Consultants in general are not as neutral as the OA, with maybe the exception where the consultant is an officially certified controller. This neutrality will anyway be questioned if the quality controller is also performing energy audits. The clear benefit a consultant provides is the technical competence. A control process with a team of consultants will increase the neutrality factor but also the increased cost per checked audit report. The requirements defined for the performer concern naturally all members of the team.

The Client

I no other quality control process is introduced, the work will be totally on the client's shoulders. Those clients that are continuously implementing energy audits will develop a good understanding on the expected outcomes but the majority of clients are not in that position. Moreover, only the clients with a large building stock have their own specialist who can (at least to some point) evaluate the technical viability of the proposed measures – the others just have to rely on the auditors' competence. Due to the lack of experience, a client can also be a non-neutral quality control performer from the auditors' point of view. A personal opinion can sometimes overcome a technical fact.

5.6 Financial connections of quality control

The quality control has connections to the financial aspects of an energy audit programme. If there is a subsidy scheme involved, the Operating Agent should consider what kind of connection there is to quality control. The two options are:

- Subsidy is paid after quality control
- Subsidy is paid before quality control

Subsidy paid after quality control

The effect of the quality control is stronger if the subsidy is paid only after the auditor's work has been accepted. If any corrections are needed, the auditors will more easily put an effort to do what is required. This option will, however, set tighter schedule limits for the control process. The clients won't be satisfied if the payments are held due to the OA's resource problems. The normal subsidy procedure requires that the auditor's fee has been paid before the subsidy can be paid.

Another major problem can occur if an authorised auditor produces a really poor report, which is rejected by the OA. The client has ordered the work in the good faith, believing that an authorised auditor can do the work, and he has paid the fee just to find out that the subsidy will not be paid. For small client companies it might be very difficult to claim and also get the fee paid back.

Subsidy paid before quality control

With this option all the payments take place before the quality control. In this case the only way to force an auditor to correct a poor report is the threat of a cancelled authorisation. To some extent the market place will take care of these poor actors but there will always be some clients ready to accept the tender of work with the lowest price – a feature often connected to poor work.

The benefit of this option is the flexibility with quality control schedules. This option is not necessarily a poor one if the general quality of work is good and the majority of the auditors are trustworthy. If the quality controller does not have the sufficient resources for the quality control process but the programme is in general functioning well, this might be a good compromise - if not the only option.

5.7 Recommendations

One way of determining the usefulness of the quality control is to estimate how much financial resources will be wasted if some 10-15% of the reports are of poor quality and useless for the client. Another sum can be calculated by estimating e.g. how much financial resources will be wasted if the saving potential expected of the total consumption of the target sectors will be reduced by 1%. This is can be taken as the minimum effect due to the lack of quality control. It can also be used to determine how much resources can be put to the work and still be on the cost-effective side.

As an example in the Finland's Energy Audit Programme some 200-250 000 € per year would be wasted due to the share of poor reports and 2-3 million € per year due to the decreased saving potentials. Taking this into account the 25-30 000 € per year spent on the quality control is money well worth its value.

In comparison to training and authorisation the recipe of a state-of-the-art quality control is without so many different options and the following approach can be recommended:

- Systematic quality control – the whole process well planned and defined
- Control based on checking audit reports - with the option that quality control audits can be used when necessary
- Control covering all projects – not all reports but always one or a few picked from a project, clearly defined criteria on how these reports are selected
- Thorough checking of reports by professional controllers
- Some tools of quality control used to rationalise the work – here it is a question of the size of the programme, in small programmes manual handling can work also
- Cost for the first quality control round covered by the Administrator, second rounds by the auditors
- Performer of the control mainly the OA - but assisted by one or a few hand-picked consultants experienced in the area but not performing the energy audits within the programme
- Subsidy paid after the quality control process – assuming adequate resources are available to carry out the work in reasonable schedule

The effect of the quality control can be strengthened by:

- Introducing a grading system and the OA advertising only those companies with good or excellent grades
- The OA working closely together with the auditors and clients instead of just giving grades to reports

But unfortunately the quality control process, although in fact very profitable work, is not very sexy and adequate resources might not be available. To some level compromising is possible without endangering the effect - but finally there is the question if one can question whether quality control really exists in a way that it would make a difference.

How the quality control of energy auditors' work is connected to the other elements of an energy audit programme is described in the table on the following page.

	Promotion	**EA Models**	**Training**	**Monitoring**
No quality control	Audit clients may not be convinced of good quality	Several models > poor & uneven quality is very likely	Mandatory, thorough training may help a little to avoid quality problems	Data in reports for monitoring needs is likely to be insufficient
Random & non-systematic quality control	Worst problems may be detected but may still lead to bad reputation			
Systematic quality control	Signal to audit client of a permanent programme and good quality work	Auditors are given feedback on the use of different models	Gives feedback to training needs. Eases the need of training a little	Sufficient data in reports for monitoring needs is ensured
Rough visual check	Reports look nice but may not be good for the clients' needs	Does not detect or eliminate poor work on model-specific issues		Data in reports for monitoring needs is likely to be insufficient
Summary & figure check	Worst problems may be detected but may still lead to bad reputation			Sufficient data in reports for monitoring needs is ensured
Thorough check	Signal to audit client of a permanent programme and good quality work	Auditors' knowledge on models can be tested	Gives feedback to training needs, teaches auditors in their work by giving feedback	Sufficient data in reports for monitoring needs is ensured

6 Examples

Appendix 1 shows how training, authorisation and quality control are applied in the various European countries in energy audit programmes and other programmes including audits.

The Appendix shows that

- Pre-qualification based on experience and good reputation is required from auditors in several countries even if no training or authorisation exists (Austria, Belgium, Norway, Portugal)
- In Denmark strict pre-qualification is connected to mandatory training and official authorisation
- Mandatory training exists in only very few countries (Denmark)
- Several countries have introduced short procedure training of 2-5 days (France, Finland, Netherlands)
- Authorisation exists in some form in many countries (Denmark, Finland, France, Germany, Greece *(planned but explicitly drafted)*, Netherlands, Portugal, UK)
- In Greece different levels of authorisation are foreseen depending on the experience of the auditor
- In Denmark the authorisation is sector- or programme-specific (small buildings, large buildings, industry)
- Validity of authorisation is only limited in Denmark (connected to a yearly fee) and in Portugal (5 years' time limit)
- Systematic quality control exists in many countries (Denmark, France, Finland, Netherlands and Norway) - in most cases the control includes a rough numerical check and a more detailed technical check
- Where authorisation exists, auditor's authorisation can be cancelled or frozen due to poor work as a result from quality control (Denmark, Finland and France)
- Usually the OA is responsible for the quality control (Ademe in France, Motiva in Finland, Novem in the Netherlands, etc) but the OA may also use consultants for the work (ELO-Scheme in Denmark, Oslo Econ Fund, etc)

Appendix 2 shows what kind of choices on training, authorisation and quality control have been made in the energy audit programmes in France and in Finland.

In both countries the auditor training is a relatively light procedure and more effort is put to quality control to ensure the quality of energy audits.

APPENDIX 1

TRAINING, AUTHORISATION AND QUALITY CONTROL IN ENERGY AUDIT PROGRAMMES IN DIFFERENT EUROPEAN COUNTRIES

EAP = energy audit programme
OP = other programme including energy audits

Country	Programme name	Class	Pre-qualification	Training	Authorisation	Quality control
Austria	Branch concept	OP	good reputation	no	no	in principle by Chamber of Commerce
	ÖEKV	OP	no	ÖEKV staff is trained	no	no
	Energy Check	OP ESCO	no	no	no	guarantee on results
Belgium/ Flanders	Energy distribution company audits	EAP	Agreement with utility	no	no	no
	Audits for industry	EAP				
Belgium/ Wallonia	Energy audits for industry	EAP	Degree + experience from industry	no	no	Under development
	Energy kiosk audits	EAP		Energy kiosk staff is trained		
Denmark	ELO-Scheme	EAP	Strict Based on experience	Mandatory, 9 days Test Yearly update	For person, company Yearly fee (650)	DTI Data check Random check Site visit
	EM-Scheme	EAP	Strict Based on experience	Mandatory, 9 days Test Yearly update	For person, company Yearly fee (700-800)	DTI Data check Random Site visit
	CO2 Scheme	EAP	Strict Based on experience	?	For person, company Yearly fee (60)	?
Finland	Energy Audit Programme	EAP	In principle, not checked	Procedure, 2 days Voluntary Test Voluntary yearly update	For person, for ever No fee (900-1000)	Thorough Feedback to auditor Based on report Authorisation pending

Country	Programme name	Class	Pre-qualification	Training	Authorisation	Quality control
France	Energy audit programme	EAP	Experience, company agreement for technical and non-technical issues	Training 2,5-3 days Buildings, industry	Chartering by Ademe Ademe published a list of chartered auditors (60 buildings + 50 industry)	by Ademe's agents in the Regional Delegations Also random checks Poor work leads to cancelling of charter
Germany	Vor-Ort Beratung	EAP			Personal + company authorisation. Listed by regions, published on Internet	
Greece	OPC-Operational Programme for Competitiveness	OP	*(planned)* - degree - postgraduate studies - working experience - audit experience - professional training	Thorough professional training on energy issues (>300 hours) is an asset for pre-qualification	*(planned)* for a certain audit type depending on audited system (thermal vs electrical) and audit class (A to C) according to audited system power capacity Pre-qualification criteria / Experience Company authorisation Auditors appointed by ministerial committee Official registration	Through 1) consideration of energy audit report results within investment proposal evaluation and 2) estimated target verification audits for finished energy investment-project hand-over, performed by the auditors of the OPC regional operating agents (Intermediate Management Agents)
Ireland	Annual Self Audit Scheme	OP	no	no	no	no
Nether-lands	EMA	EAP	experience competence	by Organisation of energy advisors Themes, 2 days each Voluntary	yes	
	LTA	OP	see above EMA	see above EMA	see above EMA	within the LTAs reports are checked by Novem or the provincial technical department
Norway	Building Network	OP	no	REEC staff recommended training	no	?

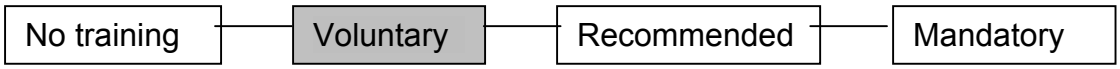
Country	Programme name	Class	Pre-qualification	Training	Authorisation	Quality control
Norway	Industrial energy efficiency network	OP	experience	energy management IFE training 1 day	no	Thorough IFE Based on report and site visits
	Oslo Econ Fund	OA	agreement consultant		no	by Interconsult
Portugal	Regulation for energy management	OP	experience		by DGE 5 years Person or company (90)	
Sweden	Eko Energy	OP		no	no	no
UK	Action Energy	OP	Yearly tender from selected consultants	Auditors are trained on technical issues, marketing, promotion, profitability calculations, etc	Energy Consultants' Register by the Institute of Energy	Three-stage control: rough check, technical check on selected reports, client feedback interviews

APPENDIX 2

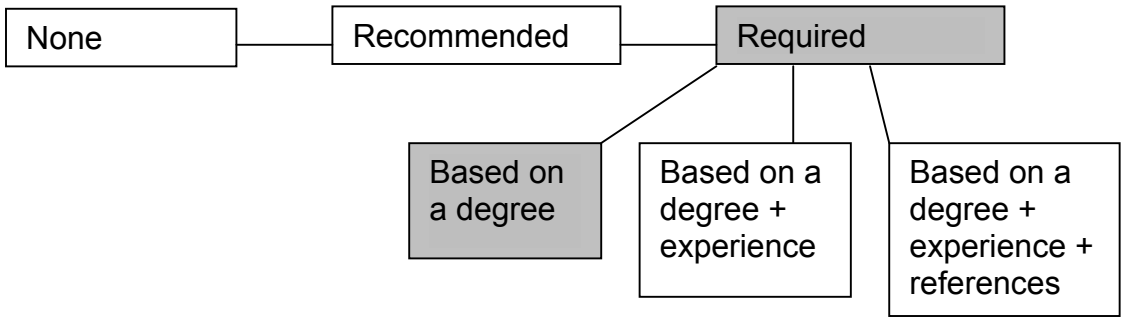
CHOICES MADE ON TRAINING, AUTHORISATION AND QUALITY CONTROL IN ENERGY AUDIT PROGRAMMES IN FRANCE AND IN FINLAND

The French EAP - DMSS: Training

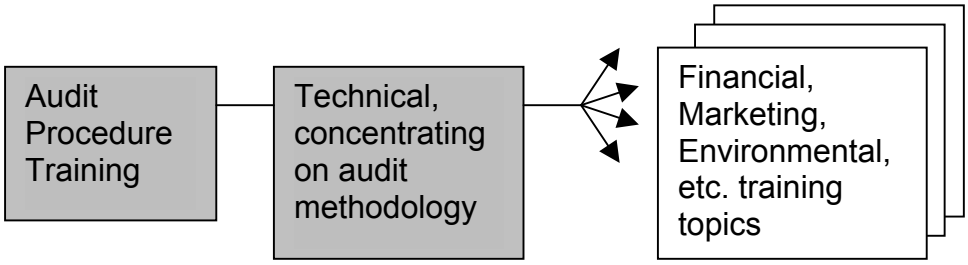
The status of energy auditor training:



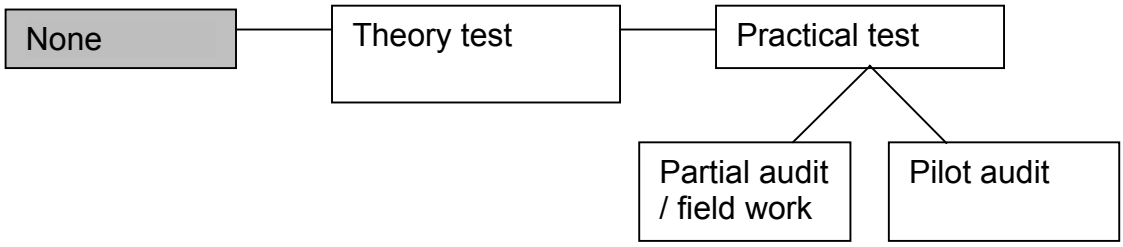
The pre-qualification for energy auditor training:



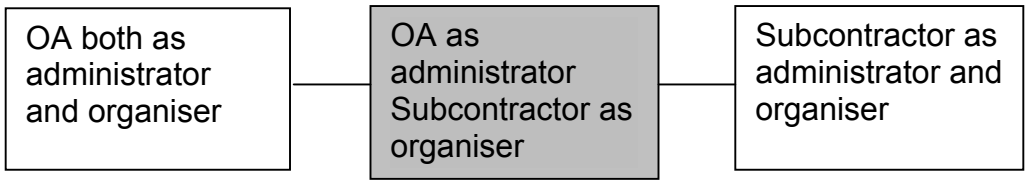
The content of energy auditor training:

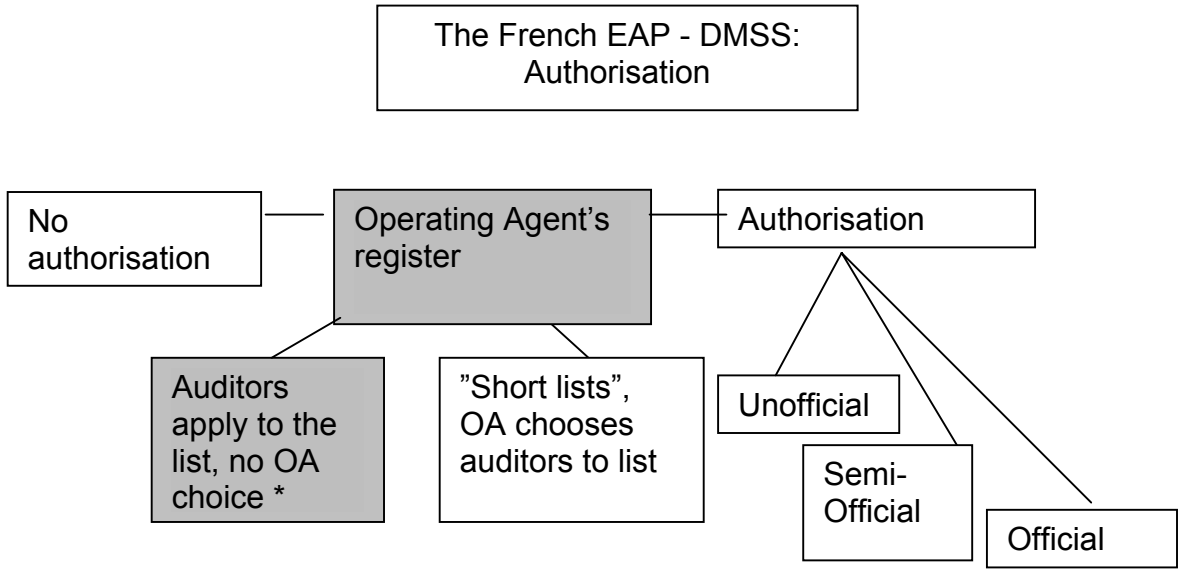


The indication of the auditor's competence:



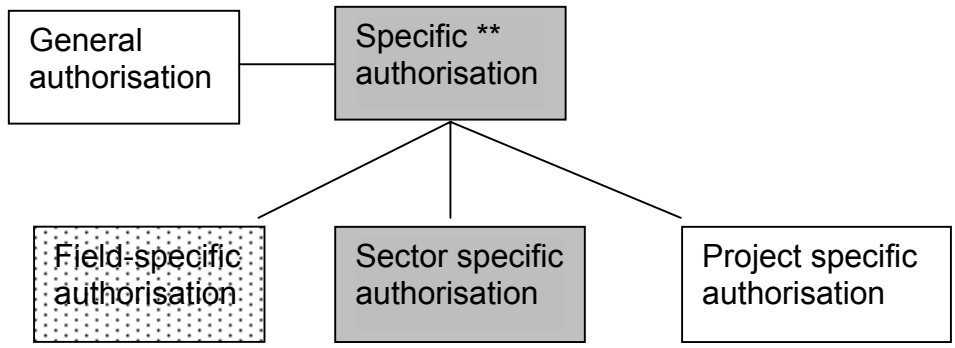
The organiser of the auditor training:





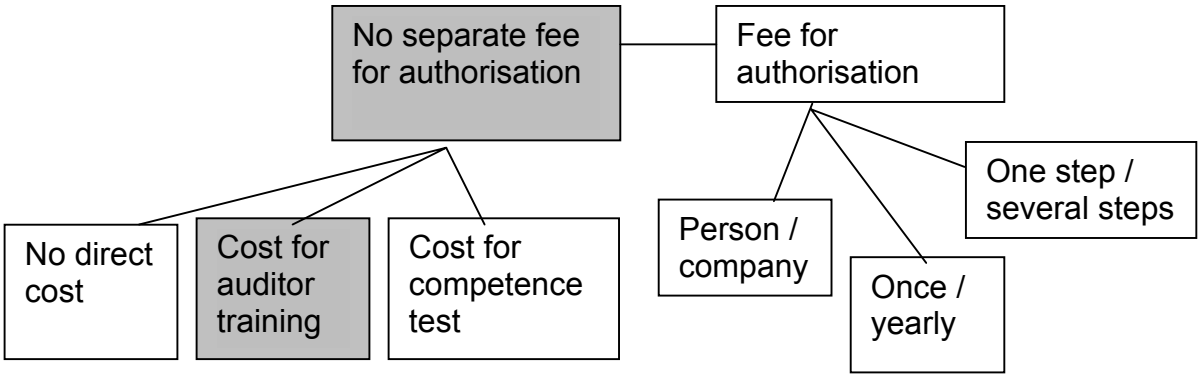
** includes a charter with conditions for remaining in the list*

The area of validity of the authorisation:



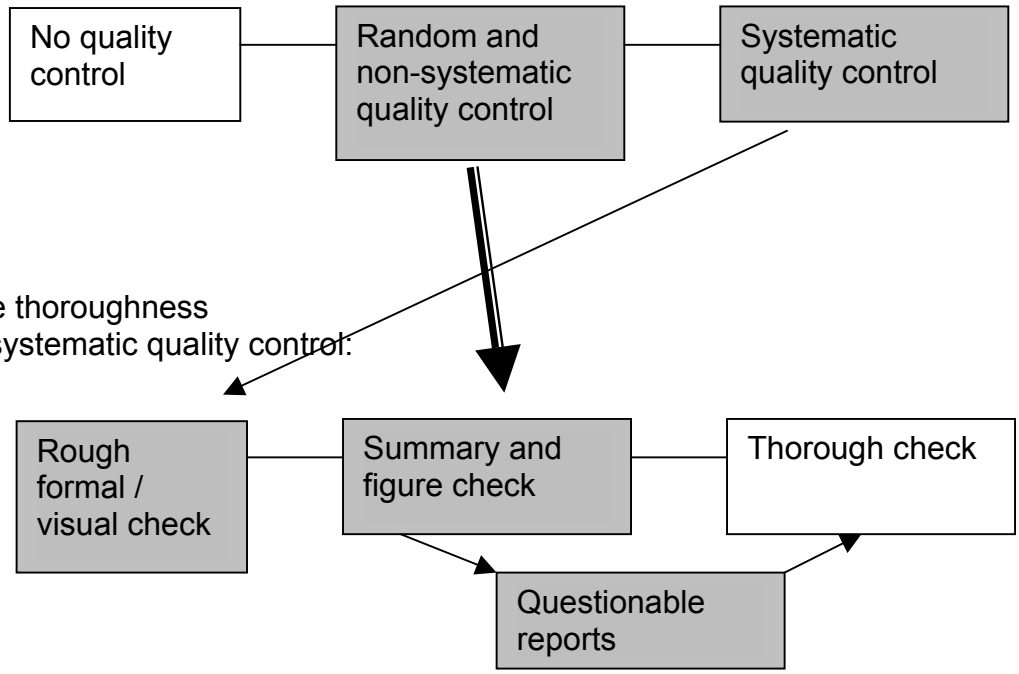
*** the DMSS covers other topics than energy, so auditors are supposed to be listed on specific fields*

The cost for authorisation:



French EAP - DMSS: Quality Control

The outline of quality control:



- Tools of quality control: Checklists + specific training for OA's agents
- Cost of quality control: The Operating Agent
- Performer of quality control: The Operating Agent
- Subsidy paid after quality control

French EAP - DMSS: Conclusions

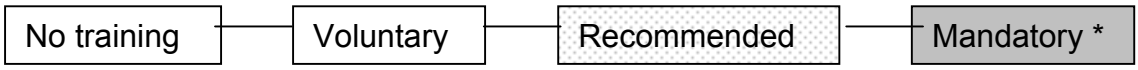
Any energy professional may carry out audits. The auditor must comply with the EAM specifications and the audit report will be evaluated by the Regional Delegation of ADEME before payment of the incentive to the building or industry benefactor. The chartering of auditors is not obligatory but ADEME publishes lists of chartered consultants. The quality of auditing is mainly relying on the expertise and qualification of the energy consultants.

The training and authorisation are rather light, which has led to more emphasis on the quality control side. The Regional Delegations work in close contact with the clients, marketing the audits, performing the quality control and doing the follow-up after the audit.

The number of clients, audit projects and auditors is high in France – regional activities are necessary in order to maintain close contact with the clients and auditors.

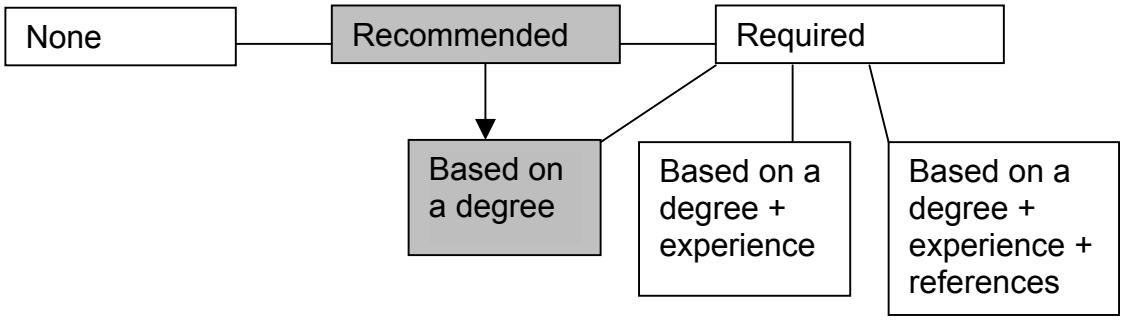
The Finnish EAP: Training

The status of energy auditor training:

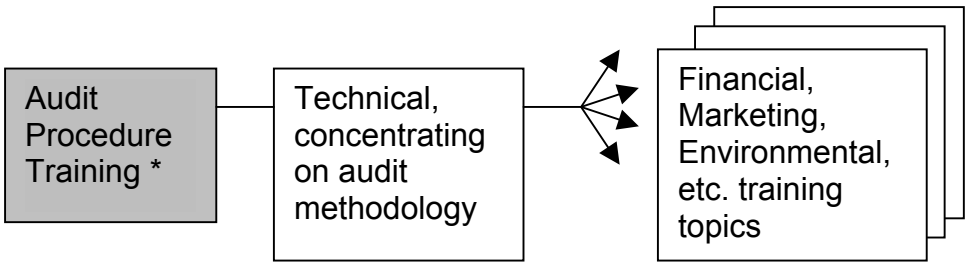


** Motiva's Energy Auditor Training is mandatory for having authorisation and to act as project manager in auditing projects.*
*** The training is recommended for assisting auditors, audit clients, etc..*

The pre-qualification for energy auditor training:

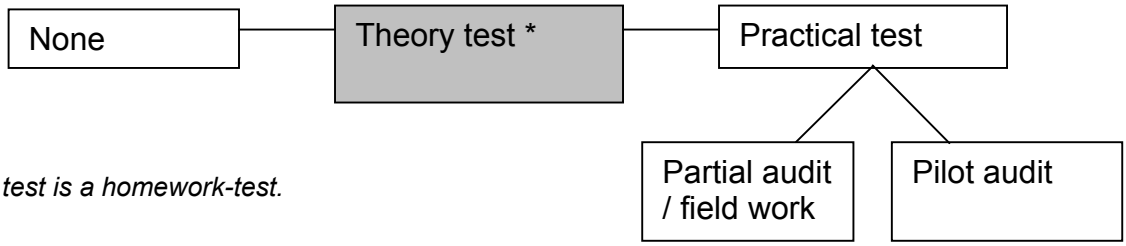


The content of energy auditor training:



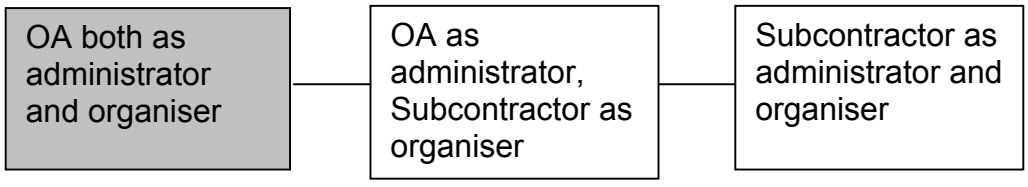
** Two-day training event, covering audit procedure, marketing, typical savings, software tool.*

The indication of the auditor's competence:



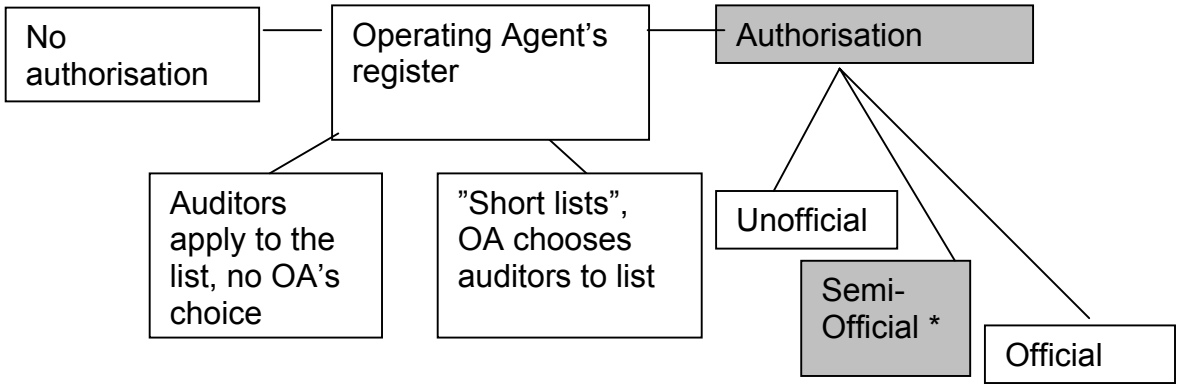
** The test is a homework-test.*

The organiser of the auditor training:



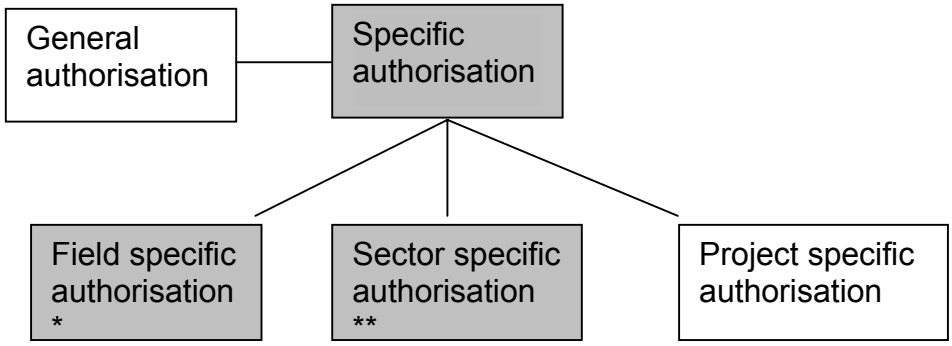
The Finnish EAP:
Authorisation

The outline of auditors' authorisation:



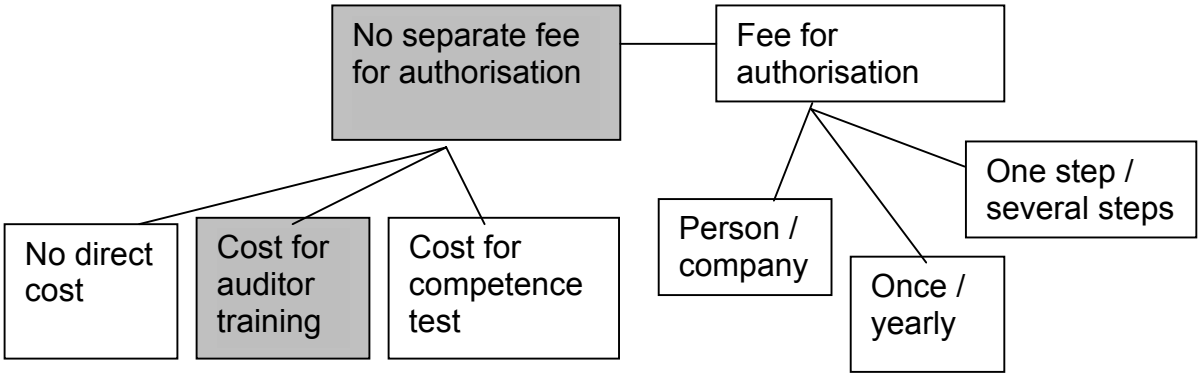
** Authorisation by Motiva.*

The area of validity of the authorisation:



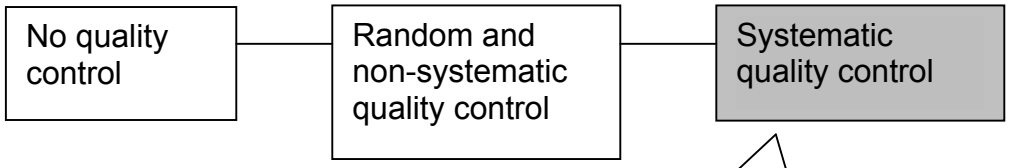
** Authorisation for mechanical and electrical auditors.*
*** Project industry personnel have a separate light authorisation procedure which is valid only in audits projects implemented in their own sites.*

The cost for authorisation:

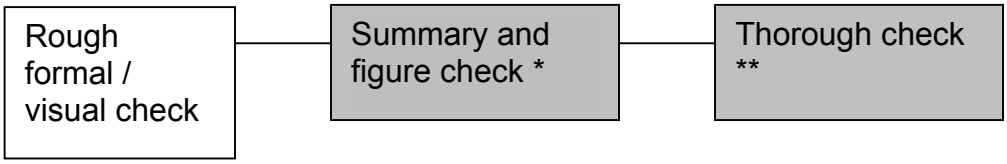


The Finnish EAP: Quality Control

The outline of quality control:



The thoroughness of systematic quality control:



** All audit reports are summary and figure checked*
*** New auditors' reports, large clients' new audits, large and special sites, etc are chosen for thorough check. Also "questionable reports" found in summary check are thoroughly checked.*

- Tools of quality control: Checklists
- Cost of quality control: The Operating Agent
- Performer of quality control: The Operating Agent & Quality Controller Consultants
- Subsidy paid before quality control

The Finnish EAP: Conclusions

In Finland the rather light training process does not guarantee that each authorised energy auditor is actually skilled enough to carry out an energy audit. The light training and authorisation is compensated by very tight quality control and auditors doing poor work are not treated gently. In principle it is relatively easy to get the authorisation but difficult to operate as an energy auditor if the quality of work is not satisfactory.

In Finland the quality control takes place after the client has paid the auditor and the subsidy paid to the client. This not a desired option but a decision made by the Administrator in 1994, which cannot be changed easily. Therefore Motiva can only influence on the energy auditors and the authorisation and quality control are in principle the strongest weapons that can be used.

Finland is a small country, the number of audits and auditors is relatively small. All training, authorisation and quality control issues are handled in Motiva in Helsinki.